FOR ADMINISTRATIVE USE
Program Area Code Proposal Code

Minnesota Wheat Research and Promotion Council

RESEARCH PROPOSAL GRANT APPLICATION

1. NAME AND ADDRESS OF ORGANIZATION TO WHICH AWARD SHOULD BE MADE

Name: North Dakota State University
Address: Office of Sponsored Programs Administration
Dept #4000 PO Box 6050, Fargo, ND 58108-6050

2. TITLE OF PROPOSAL
Nitrogen Use Efficiency of Spring Wheat Production System Across Western Minnesota

3. PRINCIPAL INVESTIGATOR(S)	4. PI #1 BUSINESS ADDRESS
Amitava Chatterjee	Department of Soil Science (7680) North Dakota State University Fargo North Dakota 58108-6050
PI# 2 Name:	
PI# 3 Name:	

5. PROPOSED PROJECT DATES (calendar years)	6. TOTAL PROJECT COST	7. PI #1 PHONE NO.
01-01-2020 to 12-31-2020 Note: Research Reports are Due November 15th of Each Year		701-231-7858

8. RESEARCH OBJECTIVES: (List objectives to be accomplished by research grant)

1. Determine nitrogen losses through leaching, volatilization, and denitrification during growing season
2. Determine soil nitrogen mineralization
3. Determine grain yield and protein content
4. Determine fertilizer-nitrogen use efficiency of spring wheat production system

Attach a 2-page detailed discussion of importance of the proposal to wheat profitability; how study complements previous research in area; procedures to be used; and competency of the research group in achieving research objectives. (Please keep the proposal concise, only 2 pages will be provided reviewers).

Signature Of Principal Investigator	Date	Phone Number
Amitava Chatterjee	12/18/19	701-231-7858

Signature Of Authorized Representative	Title	Date
Valrey V. Lothner	Associate Vice President ~~Assistant Director~~	12/19/19

Address Of Authorized Representative	Phone Number
Office of Sponsored Program Administration North Dakota State University NDSU Dept. 4000, PO Box 6050 Fargo, ND 58108-6050	701-231-8045

Minnesota Wheat Research and Promotion Council
RESEARCH PROPOSAL GRANT APPLICATION
(2-pages maximum)

Project Title:

Nitrogen Use Efficiency of Spring Wheat Production System Across Western Minnesota

Importance of this project to the profitability of wheat producers:

Adequate nitrogen (N) fertilization is critical for optimizing wheat yield and grain protein content. Nitrogen losses associated with fertilizer application have negative economic and environmental consequences. Therefore, N losses through denitrification (N_2O), volatilization (NH_3) and leaching (NO_3^-) from wheat production system has local environmental implications with regard to gas emissions and water quality.

Nitrogen Fertilizer Rule by Minnesota Department of Agriculture (MDA), is aimed to reduce nitrate losses in areas with high nitrate in groundwater. The permissible limit of nitrate concentration is 10 mg/L or ppm. The application of nitrogen fertilizer in the fall or on frozen soils will be restricted in areas with vulnerable groundwater. If nitrogen fertilizer best management practices are not being used, the area can move into a regulatory level. MN wheat growers are interested to know the losses of applied fertilizer N to improve the N use efficiency. Amount of N losses in response to different N management practices and soil type will be determined across the western Minnesota.

Procedures:

This will be the third year of the project. In the Spring of 2020, seven to ten spring wheat fields spreading across the western Minnesota will be selected for this project. Information about cultivar selection, previous crop, fertilizer management practices, drainage, and tillage will be collected. Initial soil samples from 0-6" and 6-24" depths will be collected for the analyses of basic soil properties. After planting within each field, 100 ft by 50 ft area will be marked and four observation points 25 feet apart will set up for monitoring denitrification, volatilization and leaching of nitrogen. Beside losses, soil inorganic nitrogen of 0-6" and 6-24" depths will be collected monthly. At the end of growing season, wheat grain will be collected from 40 ft transect and grain samples will be analyzed for protein content. Detailed methods of nitrogen losses are described below.

Soil inorganic nitrogen availability and nitrogen losses, denitrification, volatilization and leaching will be determined throughout the growing season for ten spring wheat fields across the Red River Valley of Minnesota. Following methods will be used to monitor nitrogen dynamics.

Soil inorganic N concentration -Soil with depth increments of 0-6", 6-24" will be collected every week interval from fertilizer application to harvest and will be analyzed for inorganic-N (NH4+ and NO3-) concentrations using 2M KCl extraction and TL2800 Timberline Ammonia Analyzer. Changes in soil N availability and cumulative N mineralization will be calculated. After harvest, soil samples will be collected also from 6-24" to determine residual soil N content.

Leaching loss of NO_3-Soil water samples from each plot below the rooting zone will be collected at a depth of 3' (0.9 m) using a suction cup lysimeters consisting a sealed plastic tube that is equipped with a 100-kPa high flow porous ceramic cup (60-mm length, 22-mm outside diameter) (Irrometer Inc., Riverside, CA). A slight vacuum in the tube draws soil water through porous ceramic tip and water sample is collected by a syringe to the suction line extending past the top seal and a clamp to seal it off. Sample water from lysimeters will be collected once per week throughout the growing seasons. Sample water will be analyzed for NO_3-N using an automated Timberline TL2800 Ammonia Analyzer (Timberline Instruments, CO, USA).

Denitrification- loss-Soil N_2O-N efflux will be measured every week interval using static chamber installed at each plot after planting. Headspace air samples of chamber will be collected in a serum bottle using a syringe at 0, 15, 30 min interval at each observation and air samples will be analyzed by a Shimadzu gas chromatograph equipped with an electron capture detector.

Volatilization loss of ammonia (NH_3)- Volatilization losses will be measured using semi-static open chambers. A chamber will be installed in each plot after N-fertilizer application. The chambers will be secured in an upright position on the soil surface using wire stakes, surrounded by rubber bands. On the day of measurement, the foam strips and the acid solution will be collected, stored in 0.5 L mason jars containing 125 mL of 2 M KCl solution, and new traps will be replaced. The sampled traps will be transferred to the laboratory, where they will be immediately extracted with 250 mL of 2 M KCl solution. The extracts were analyzed for NH3 concentration using the ammonia analyzer.

Regional linkages to other research activities:

ND Corn council has funded the similar project for the next growing season.

List current or potential other funding sources for this project:

Graduate student responsible for this project is funded by North Dakota State University.

Research Group:

Amitava Chatterjee (PI), Don Veverka (Graduate student)

Relationship to past projects: None

Estimate the budget requirements:

Salary:
Undergraduate students (2)
2 students × $15/hr × 40 hr/wk ×16 wk +10% fringe benefits = $19,200+$1,920 = $21,120

Travel:
4 months ×4 wks. × 200 miles (roundtrip) × $0.60/mile + Depreciation cost-$200= $2,120

Supplies
Gas cylinder for gas chromatograph= $2,000
Chemicals, bags and glassware = $1,500
Protein analyses (10 fields*4 samples * $3/sample) = $120

Total= $26,860